



日 本 国 特 許 庁

JAPAN PATENT OFFICE

67471-022  
Serial No: Not yet Assigned  
McDermott, W.M. & Emerf  
Filed: 8/1/2003

別紙添付の書類に記載されている事項は下記の出願書類に記載されている事項と同一であることを証明する。

This is to certify that the annexed is a true copy of the following application as filed with this Office

出 願 年 月 日

Date of Application:

2002年 8月 1日

出 願 番 号

Application Number:

特願2002-225286

[ ST.10/C ]:

[ JP2002-225286 ]

出 願 人

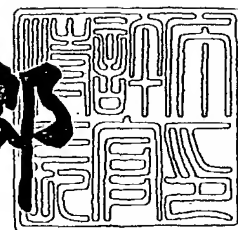
Applicant(s):

松下電器産業株式会社

2003年 1月17日

特 許 庁 長 官  
Commissioner,  
Japan Patent Office

太田 信一郎



出証番号 出証特2002-3106909

【書類名】 特許願

【整理番号】 5037730168

【提出日】 平成14年 8月 1日

【あて先】 特許庁長官 殿

【国際特許分類】 G06F 9/45

【発明者】

【住所又は居所】 大阪府門真市大字門真1006番地 松下電器産業株式会社内

【氏名】 道本 昌平

【発明者】

【住所又は居所】 大阪府門真市大字門真1006番地 松下電器産業株式会社内

【氏名】 坂田 俊幸

【発明者】

【住所又は居所】 大阪府門真市大字門真1006番地 松下電器産業株式会社内

【氏名】 小川 一

【発明者】

【住所又は居所】 大阪府門真市大字門真1006番地 松下電器産業株式会社内

【氏名】 瓶子 岳人

【発明者】

【住所又は居所】 大阪府門真市大字門真1006番地 松下電器産業株式会社内

【氏名】 高山 秀一

【特許出願人】

【識別番号】 000005821

【氏名又は名称】 松下電器産業株式会社

What is claimed is:

1 1. A compiler apparatus for generating an instruction code  
2 composed of instruction sets each including an instruction that  
3 designates an  $m$ -bit immediate value indicating a location of  
4 a data item in a memory area, comprising:

5       an allocation data selecting unit operable to sequentially  
6 select a data item from a group X composed of a plurality of  
7 data items each having a plurality of data attributes, the  
8 selection being made based on a first criterion relating to one  
9 of the data attributes;

10       an allocation judging unit operable to judge, each time  
11 a data item is selected, whether the selected data item is  
12 allocatable to an  $n$ -byte memory area, where  $n \leq 2^m$ ; and

13       an exclusion data specifying unit operable to specify,  
14 when the judgment is negative, a data item to be excluded from  
15 the group X out of all data items having been selected, the  
16 specification being made based on a second criterion relating  
17 to a different one of the data attributes, wherein

18       the allocation data selecting unit repeats the selection  
19 from data items that remain in the group X after excluding all  
20 data items having been specified to be excluded, until all the  
21 remaining data items are judged to be allocatable to the memory  
22 area.

1 2. The compiler apparatus according to Claim 1, wherein  
2       the first criterion is a descending order of an alignment

3 of each data item, the alignment being a value representing a  
4 strength of a constraint on an allocatable location of a  
5 corresponding data item in a memory area,

6 the allocation data selecting unit selects a data item  
7 in the descending order of an alignment of each data item,

8 the second criterion is a descending order of a size of  
9 each data item, and

10 the exclusion data specifying unit specifies a data item  
11 in the descending order of a size of each data item.

1 3. The compiler apparatus according to Claim 2, further comprises

2 a re-allocation data selecting unit operable to  
3 sequentially select, after the allocation data selecting unit  
4 completes the selection, a data item from the excluded data items,  
5 the selection by the re-allocation data selecting unit being  
6 made in an ascending order of a size of each data item, wherein

7 the allocation judging unit further judges, each time a  
8 data item is selected by the re-allocation data selecting unit,  
9 the selected data item is allocatable to the memory area.

1 4. The compiler apparatus according to Claim 1, wherein

2 the allocation data selecting unit further sequentially  
3 selects, after completing the selection, a data item from the  
4 excluded data items, the further-selection being made based on  
5 the first criterion,

6 the allocation judging unit further judges, each time a  
7 data item is further-selected, whether the further-selected data

8 item is allocatable to another memory area,  
9 the exclusion data specifying unit further specifies, when  
10 the further judgment is negative, a data item to be re-excluded  
11 from the excluded data items out of all data items having been  
12 further-selected, the further specification being made based  
13 on the second criterion, and  
14 the allocation data selecting unit repeats the  
15 further-selection from data items that remain after excluding  
16 all data items having been further specified to be re-excluded,  
17 until all the remaining data items are judged to be allocatable  
18 to said another memory area, and  
19 when there are any re-excluded data items after completing  
20 the further-selection,  
21 the allocation data selecting unit further selects a data  
22 item sequentially from the re-excluded data items,  
23 the allocation judging unit further judges, each time a  
24 data item is further selected from the re-excluded data items,  
25 whether the further-selected data item is allocatable to a yet  
26 another memory area, and  
27 the exclusion data specifying unit further specifies a  
28 data item when the further judgment is negative.

1 5. The compiler apparatus according to Claim 4, wherein  
2 the first criterion is a descending order of an alignment  
3 of each data item, the alignment being a value representing a  
4 strength of a constraint on an allocatable location of a  
5 corresponding data item in a memory area, and

6       the second criterion is a descending order of a size of  
7 each data item.

1   6. The compiler apparatus according to Claim 4, wherein  
2       the first criterion is a descending order of an alignment  
3 of each data item, the alignment being a value representing a  
4 strength of a constraint on an allocatable location of a  
5 corresponding data item in a memory area, and  
6       the second criterion is an ascending order of a reference  
7 frequency of each data item, the reference frequency representing  
8 how frequently a corresponding data item is referenced.

1   7. The compiler apparatus according to Claim 1, wherein  
2       the first criterion is a descending order of an alignment  
3 of each data item, the alignment being a value representing a  
4 strength of a constraint on an allocatable location of a  
5 corresponding data item in a memory area,  
6       the allocation data selecting unit selects a data item  
7 in the descending order of an alignment of each data item,  
8       the second criterion is an ascending order a reference  
9 frequency of each data item, the reference frequency representing  
10 how frequently a corresponding data item is referenced, and  
11       the exclusion data specifying unit specifies a data item  
12 in the ascending order of a reference frequency of each data  
13 item.

1   8. The compiler apparatus according to Claim 7, further

2 comprising

3       a re-allocation data selecting unit operable to  
4 sequentially select, after the allocation data selecting unit  
5 completes the selection, a data item from the excluded data items,  
6 the selection by the re-allocation data selecting unit being  
7 made in a descending order of a reference frequency of each data  
8 item, wherein

9       the allocation judging unit further judges, each time a  
10 data item is selected by the re-allocation data selecting unit,  
11 whether the selected data item is allocatable to the memory area.

1   9. A data location determining method for a compiler apparatus  
2 to generate an instruction code composed of instruction sets  
3 each including an instruction that designates an  $m$ -bit immediate  
4 value indicating a location of a data item in a memory area,  
5 the method comprising:

6       an allocation data selecting step of sequentially  
7 selecting a data item from a group  $X$  composed of a plurality  
8 of data items each having a plurality of data attributes, the  
9 selection being made based on a first criterion relating to one  
10 of the data attributes;

11       an allocation judging step of judging, each time a data  
12 item is selected, whether the selected data item is allocatable  
13 to an  $n$ -byte memory area, where  $n \leq 2^m$ ; and

14       an exclusion data specifying step of specifying, when the  
15 judgment is negative, a data item to be excluded from the group  
16  $X$  out of all data items having been selected, the specification

17 being made based on a second criterion relating to a different  
18 one of the data attributes, wherein  
19 the allocation data selecting step repeats the selection  
20 from data items that remain in the group X after excluding all  
21 data items having been specified to be excluded, until all the  
22 remaining data items are judged to be allocatable to the memory  
23 area.

1 10. The data location determining method according to Claim 9,  
2 wherein  
3 the first criterion is a descending order of an alignment  
4 of each data item, the alignment being a value representing a  
5 strength of a constraint on an allocatable location of a  
6 corresponding data item in a memory area,  
7 the allocation data selecting step selects a data item  
8 in the descending order of an alignment of each data item,  
9 the second criterion is a descending order of a size of  
10 each data item, and  
11 the exclusion data specifying step specifies a data item  
12 in the descending order of a size of each data item.

1 11. The data location determining method according to Claim 9,  
2 wherein  
3 the first criterion is a descending order of an alignment  
4 of each data item, the alignment being a value representing a  
5 strength of a constraint on an allocatable location of a  
6 corresponding data item in a memory area,



7           the allocation data selecting step selects a data item  
8 in the descending order of an alignment of each data item,  
9           the second criterion is an ascending order a reference  
10 frequency of each data item, the reference frequency representing  
11 how frequently a corresponding data item is referenced, and  
12           the exclusion data specifying step specifies a data item  
13 in the ascending order of a reference frequency of each data  
14 item.

1   12. The data location determining method according to Claim 9,  
2 wherein

3           the allocation data selecting step further sequentially  
4 selects, after completing the selection, a data item from the  
5 excluded data items, the further-selection being made based on  
6 the first criterion,

7           the allocation judging step further judges, each time a  
8 data item is further-selected, whether the further-selected data  
9 item is allocatable to another memory area,

10           the exclusion data specifying step further specifies, when  
11 the further judgment is negative, a data item to be re-excluded  
12 from the excluded data items out of all data items having been  
13 further-selected, the further specification being made based  
14 on the second criterion, and

15           the allocation data selecting step repeats the  
16 further-selection from data items that remain after excluding  
17 all data items having been further specified to be re-excluded,  
18 until all the remaining data items are judged to be allocatable

19 to said another memory area, and  
20 when there are any re-excluded data items after completing  
21 the further-selection,  
22 the allocation data selecting step further selects a data  
23 item sequentially from the re-excluded data items,  
24 the allocation judging step further judges, each time a  
25 data item is further selected from the re-excluded data items,  
26 whether the further-selected data item is allocatable to a yet  
27 another memory area, and  
28 the exclusion data specifying step further specifies a  
29 data item when the further judgment is negative.

1 13. The data location determining method according to Claim 12,  
2 wherein  
3 the first criterion is a descending order of an alignment  
4 of each data item, the alignment being a value representing a  
5 strength of a constraint on an allocatable location of a  
6 corresponding data item in a memory area, and  
7 the second criterion is a descending order of a size of  
8 each data item.

1 14. The data location determining method according to Claim 12,  
2 wherein  
3 the first criterion is a descending order of an alignment  
4 of each data item, the alignment being a value representing a  
5 strength of a constraint on an allocatable location of a  
6 corresponding data item in a memory area, and

7           the second criterion is an ascending order of a reference  
8 frequency of each data item, the reference frequency representing  
9 how frequently a corresponding data item is referenced.

1   15. A program for a compiler apparatus to generate an instruction  
2 code composed of instruction sets each including an instruction  
3 that designates an  $m$ -bit immediate value indicating a location  
4 of a data item in a memory area, the program comprising:

5       an allocation data selecting step of sequentially  
6 selecting a data item from a group  $X$  composed of a plurality  
7 of data items each having a plurality of data attributes, the  
8 selection being made based on a first criterion relating to one  
9 of the data attributes;

10       an allocation judging step of judging, each time a data  
11 item is selected, whether the selected data item is allocatable  
12 to an  $n$ -byte memory area, where  $n \leq 2^m$ ; and

13       an exclusion data specifying step of specifying, when the  
14 judgment is negative, a data item to be excluded from the group  
15  $X$  out of all data items having been selected, the specification  
16 being made based on a second criterion relating to a different  
17 one of the data attributes, wherein

18       the allocation data selecting step repeats the selection  
19 from data items that remain in the group  $X$  after excluding all  
20 data items having been specified to be excluded, until all the  
21 remaining data items are judged to be allocatable to the memory  
22 area.

1 16. The program according to Claim 15, wherein  
2 the first criterion is a descending order of an alignment  
3 of each data item, the alignment being a value representing a  
4 strength of a constraint on an allocatable location of a  
5 corresponding data item in a memory area,  
6 the allocation data selecting step selects a data item  
7 in the descending order of an alignment of each data item,  
8 the second criterion is a descending order of a size of  
9 each data item, and  
10 the exclusion data specifying step specifies a data item  
11 in the descending order of a size of each data item.

1 17. The program according to Claim 15, wherein  
2 the first criterion is a descending order of an alignment  
3 of each data item, the alignment being a value representing a  
4 strength of a constraint on an allocatable location of a  
5 corresponding data item in a memory area,  
6 the allocation data selecting step selects a data item  
7 in the descending order of an alignment of each data item,  
8 the second criterion is an ascending order a reference  
9 frequency of each data item, the reference frequency representing  
10 how frequently a corresponding data item is referenced, and  
11 the exclusion data specifying step specifies a data item  
12 in the ascending order of a reference frequency of each data  
13 item.

1 18. The program according to Claim 15, wherein

2       the allocation data selecting step further sequentially  
3 selects, after completing the selection, a data item from the  
4 excluded data items, the further-selection being made based on  
5 the first criterion,

6       the allocation judging step further judges, each time a  
7 data item is further-selected, whether the further-selected data  
8 item is allocatable to another memory area,

9       the exclusion data specifying step further specifies, when  
10 the further judgment is negative, a data item to be re-excluded  
11 from the excluded data items out of all data items having been  
12 further-selected, the further specification being made based  
13 on the second criterion, and

14       the allocation data selecting step repeats the  
15 further-selection from data items that remain after excluding  
16 all data items having been further specified to be re-excluded,  
17 until all the remaining data items are judged to be allocatable  
18 to said another memory area, and

19       when there are any re-excluded data items after completing  
20 the further-selection,

21       the allocation data selecting step further selects a data  
22 item sequentially from the re-excluded data items,

23       the allocation judging step further judges, each time a  
24 data item is further selected from the re-excluded data items,  
25 whether the further-selected data item is allocatable to a yet  
26 another memory area, and

27       the exclusion data specifying step further specifies a  
28 data item when the further judgment is negative.

1 19. The program according to Claim 18, wherein  
2 the first criterion is a descending order of an alignment  
3 of each data item, the alignment being a value representing a  
4 strength of a constraint on an allocatable location of a  
5 corresponding data item in a memory area, and  
6 the second criterion is a descending order of a size of  
7 each data item.

1 20. The program according to Claim 18, wherein  
2 the first criterion is a descending order of an alignment  
3 of each data item, the alignment being a value representing a  
4 strength of a constraint on an allocatable location of a  
5 corresponding data item in a memory area, and  
6 the second criterion is an ascending order of a reference  
7 frequency of each data item, the reference frequency representing  
8 how frequently a corresponding data item is referenced.

1 21. A computer-readable recording medium storing thereon a  
2 program for a compiler apparatus to generate an instruction code  
3 composed of instruction sets each including an instruction that  
4 designates an *m*-bit immediate value indicating a location of  
5 a data item in a memory area, the program comprising:  
6 an allocation data selecting step of sequentially  
7 selecting a data item from a group X composed of a plurality  
8 of data items each having a plurality of data attributes, the  
9 selection being made based on a first criterion relating to one  
10 of the data attributes;

11           an allocation judging step of judging, each time a data  
12 item is selected, whether the selected data item is allocatable  
13 to an  $n$ -byte memory area, where  $n \leq 2^m$ ; and  
14           an exclusion data specifying step of specifying, when the  
15 judgment is negative, a data item to be excluded from the group  
16 X out of all data items having been selected, the specification  
17 being made based on a second criterion relating to a different  
18 one of the data attributes, wherein  
19           the allocation data selecting step repeats the selection  
20 from data items that remain in the group X after excluding all  
21 data items having been specified to be excluded, until all the  
22 remaining data items are judged to be allocatable to the memory  
23 area.

1   22. The computer-readable recording medium according to Claim  
2   21, wherein  
3           the first criterion is a descending order of an alignment  
4 of each data item, the alignment being a value representing a  
5 strength of a constraint on an allocatable location of a  
6 corresponding data item in a memory area,  
7           the allocation data selecting step selects a data item  
8 in the descending order of an alignment of each data item,  
9           the second criterion is a descending order of a size of  
10 each data item, and  
11           the exclusion data specifying step specifies a data item  
12 in the descending order of a size of each data item.

1 23. The computer-readable recording medium according to Claim  
2 21, wherein

3 the first criterion is a descending order of an alignment  
4 of each data item, the alignment being a value representing a  
5 strength of a constraint on an allocatable location of a  
6 corresponding data item in a memory area,

7 the allocation data selecting step selects a data item  
8 in the descending order of an alignment of each data item,

9 the second criterion is an ascending order a reference  
10 frequency of each data item, the reference frequency representing  
11 how frequently a corresponding data item is referenced, and

12 the exclusion data specifying step specifies a data item  
13 in the ascending order of a reference frequency of each data  
14 item.

1 24. The computer-readable recording medium according to Claim  
2 21, wherein

3 the allocation data selecting step further sequentially  
4 selects, after completing the selection, a data item from the  
5 excluded data items, the further-selection being made based on  
6 the first criterion,

7 the allocation judging step further judges, each time a  
8 data item is further-selected, whether the further-selected data  
9 item is allocatable to another memory area,

10 the exclusion data specifying step further specifies, when  
11 the further judgment is negative, a data item to be re-excluded  
12 from the excluded data items out of all data items having been



13 further-selected, the further specification being made based  
14 on the second criterion, and

15 the allocation data selecting step repeats the  
16 further-selection from data items that remain after excluding  
17 all data items having been further specified to be re-excluded,  
18 until all the remaining data items are judged to be allocatable  
19 to said another memory area, and

20 when there are any re-excluded data items after completing  
21 the further-selection,

22 the allocation data selecting step further selects a data  
23 item sequentially from the re-excluded data items,

24 the allocation judging step further judges, each time a  
25 data item is further selected from the re-excluded data items,  
26 whether the further-selected data item is allocatable to a yet  
27 another memory area, and

28 the exclusion data specifying step further specifies a  
29 data item when the further judgment is negative.

1 25. The computer-readable recording medium according to Claim  
2 24, wherein

3 the first criterion is a descending order of an alignment  
4 of each data item, the alignment being a value representing a  
5 strength of a constraint on an allocatable location of a  
6 corresponding data item in a memory area, and

7 the second criterion is a descending order of a size of  
8 each data item.

1 26. The computer-readable recording medium according to Claim  
2 24, wherein

3 the first criterion is a descending order of an alignment  
4 of each data item, the alignment being a value representing a  
5 strength of a constraint on an allocatable location of a  
6 corresponding data item in a memory area, and

7 the second criterion is an ascending order of a reference  
8 frequency of each data item, the reference frequency representing  
9 how frequently a corresponding data item is referenced.